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# ELECTRICITY IN MEDICINE,

INCLUDING A SPECIAL ACCOUNT OF

THE GALVANO-CAUTERY IN NASAL SURGERY.

—BY—

HARRISON ALLEN, M.D.

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## ELECTRICITY IN MEDICINE.

BY HARRISON ALLEN, M. D.

[Abstracts from a lecture on the subject of "Electricity in Medicine," delivered at the International Electrical Exhibition, Tuesday evening, September 30, 1884.]

[The lecture, as originally delivered before the International Electrical Exhibition, included a general resumé of the applications of electricity to the study of the phenomena of life, and especially to the practice of medicine. Of necessity a subject so comprehensive when arranged in a manner suitable for a popular occasion admitted of no expression of individual views, and indeed was so treated as to give to the auditor a general idea of the importance of electricity as an aid to physiology and to therapeutics, rather than to elaborate a single theme of interest to the investigator. After reverting to the phenomena of electrical animals, the lecturer passed to the observations of Franklin on the constant current upon the living body. An account of the researches of Galvani and Volta followed, and a succinct description was presented of the uses of these varieties of electricity in medicine as contrasted with that of faradism. The applications of the incandescent wire as a cautery as well as a means of illumination of the throat-passages ensued. Examples were given of the methods of Duchenne in studying the functions of muscles by determining isolated contractions of separate muscles by the induced current as well as the method referred to Reichenbach as a means of ascertaining the effects of a powerful current of electricity) which was caused to be passed through a powerful stationary magnet) upon the sense of sight. The method last-named was held by the lecturer to have special interest at this time, since the organizations of societies devoted to psychical research would probably lead to the repetition of the Baron von Reichenbach's experiments in this country.]

In selecting from this extensive range of subjects one theme which would bear elaboration, the author has concluded that an exposition of that form of electricity in the application of which he is personally the most interested, would afford the best opportunity of presenting observations which might claim to be original, namely, in the use of the galvano-cautery as an agent in the treatment of diseases of the nasal chambers.—H. A.]



LADIES AND GENTLEMEN: I desire to bring to your attention this evening a subject in which I have for a number of years felt a warm interest; indeed, to such an extent is this the case, that this lecture in great part will be a statement of my own experience. It will make no pretence to be any other than a record of my own conclusions on a subject of great practical importance.

#### THE GALVANO-CAUTERY IN NASAL SURGERY.

In 1873 I began a series of observations on the use of the galvano-cautery in the treatment of nasal disease. At that time the only battery available for the purpose was that of Burn's, an instrument which, notwithstanding the fact that its activity is dependent upon the immersion of the plates in a stationary bath, and the additional defect that currents of air are to be constantly transmitted through the fluid to secure efficacy, combines many advantages, among which may be mentioned its portability, the ease with which it can be cleansed, and, I may add, its durability, for the instrument at that time purchased has been in almost daily use for ten years. The greater number of these observations now recorded, therefore, were made with the Burn battery, although I have supplemented it in my practice with a larger, more efficient, yet bulkier instrument. At the beginning of my studies I was much discouraged to find that the conductors, the electrode, and the circuit maker, were all large, heavy, and imperfectly adapted for use upon chambers, so small and imperfectly illuminated, as are those of the nose. The cords were heavy and cable-like, and the electrodes adapted for the coarser purposes of surgery. In these respects they were admirably adapted (let it be understood) to all operations in general surgery, and especially to those involving vascular structures, such as the tongue. I desire to return my acknowledgments to Mr. Otto Flemming, of Philadelphia, to whom the problem was presented in 1874, to furnish for the purpose I designed, a more delicate electrode and a lighter and more available form of conducting cords. Without detaining you with the details of Mr. Flemming's efforts, aided by my own suggestions, I succeeded about the time above-mentioned in having prepared for my use a form of electrode which has remained to this day the basis upon which all similar instruments have been made which have been used by me (Fig. 1.) The electrode is simply a pair of delicate copper wires, measuring a little over one millimeter in diameter, separated throughout their entire lengths by asbestos, except at those portions which are continuous with a terminal

platinum loop. The copper wires and asbestos are firmly wrapped with insulating silk, and the entire instrument when completed will present an average length of fifteen centimetres, a width of from two to three millimetres, and the platinum loop varying in length from three to fifteen millimetres. The weight of each one of these electrodes never exceeds 148 grains. Such an electrode is flexible, is readily cleansed, is light in weight, and is durable. The platinum loop at the end of the instrument can be modified in shape in ways already understood by electricians, and nothing novel is presented under that head. The extent, however, to which the platinum loop may be made to extend beyond the copper wires is a matter of much importance, if it is desired to make a linear eschar. It follows that the length of the platinum loop will determine the length of the eschar itself. When, however, a mere point of contact with the living membrane is desired, there is no objection to wrapping the electrode almost its entire length, thus leaving a mere tip of the platinum exposed. When it is desired to apply the cautery to the naso-pharynx, it is prudent to wrap every part of the instrument except its free end, in order that the posterior edge of the soft palate be not involved in the burn.

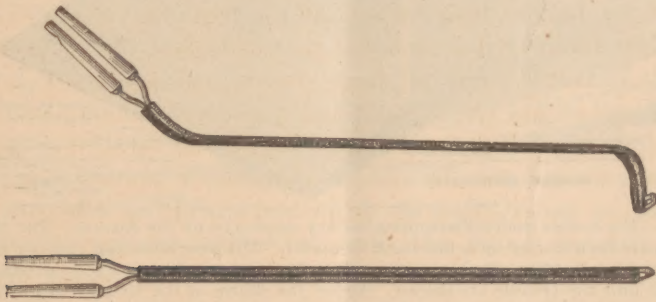


FIG. 1.—Two electrodes of peculiar shape in use by the Author.

The width of the cable with which I began my observations equalled about ten millimetres; but for the last year, I have succeeded in having very satisfactory results from a cord exactly one-half this width and of corresponding light weight. I desire next to call your attention to the battery which I have now in use, a battery designed by Dr. Carl Seiler and Mr. Otto Flemming, and known under their names. The novelty of the battery consists in the fact that the plates themselves are stationary, and the fluid is brought in contact with them by an upward motion which is determined by the pressure of the operator

upon a treadle. The advantage of this method of bringing the plates in contact with the fluid is a decided one. The moment the foot of the operator is removed from the treadle, the current ceases, and there is no danger as is so often acknowledged to exist in the use of the Burn battery, of neglecting the plates and allowing them to remain in immersion a longer time than is needed.

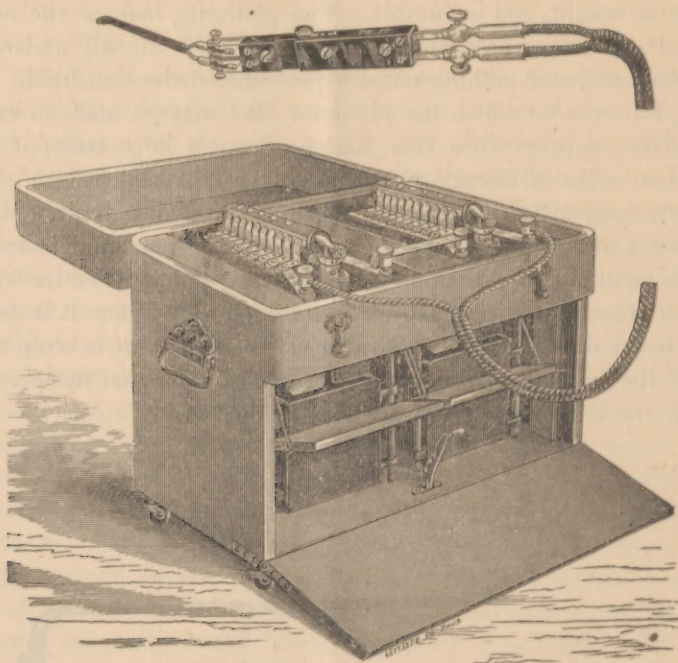


FIG. 2.—The double Seller-Flemming battery employed by the Author. The two sets of plates are seen united by a flat band of metal. The case inclosing the two separate batteries opens in front, displaying the cells. The plates (which are seen pendant over the cells) and the treadle are shown. Above the figure of the battery lies a figure of the Flemming electrode-handle and the electrode in position.

We have in this apparatus an exceedingly powerful agent, especially when the battery is made of double strength, as I have of late been using it (Fig. 2); that is to say when two batteries (each one representing the chemical strength of that instrument known as the "Seiler-Flemming Battery," worked by a single treadle) are united. A current from this powerful instrument is passed into a single short loop of platinum wire, and develops a heating effect of the highest destructive power. Yet the degree of heat is so rapidly evolved as to produce the desired effect upon the membrane with the least amount of pain. It may be held

as an axiom in the application of the galvano-cautery, that the pain of an application is in direct ratio to a low degree of incandescence; or, expressed differently, the ease with which the applications can be borne is in direct ratio to the scintillating appearance of the loop and of the white color which attends incandescence. The single disadvantage associated with the employment of the white scintillating incandescence is the danger, or rather the liability, of fusing the platinum wire; but this can be readily averted by bringing the wire in contact with the tissues which it is destined to destroy, immersing the plates in the fluid, and then making a current. The contact should be of momentary duration, and be limited simply by the time which the will-power can press upon the button at the side of the current-maker. The moment the finger presses the button inward there is a quick flash of light from the electrode; the instant it is removed, the wire again becomes of the ordinary appearance of platinum; so that while the process of destruction is going on, the finger of the operator is opening and closing the circuit very much after the manner in which a telegraph operator works the Morse indicator. With one exception, which followed upon the incautious pressure of the button, thus making a circuit before the battery fluid was raised up against the plates, I have never fused a platinum loop. In the instance named the short interval of time which intervened between the appreciation of intense heat, which I had thus inadvertently maintained in the loop, and the time required for me to break the circuit was sufficient to fuse the wire.

It goes without saying that with a battery so powerful, great prudence is required in manipulating the electrode; but when properly used and with the precautions which naturally belong to the use of all surgical agencies whatsoever upon the living economy, I can say that the galvano-cautery in the treatment of nasal disease is absolutely safe. The single point which may be urged—that is to say, one which at least came to me with a sense of surprise—was the effect upon the tissues at the side of the platinum wire not in contact with it, but simply in its neighborhood. The tissues were thrown into a state of high vascular excitement by the presence of the heated loop near them; and one can very readily understand that the amount of radiant heat thrown off to the membranes in their immediate proximity from the heated wires would produce a roasting effect if long maintained in one position; but fortunately, almost all effects desired by the use of the cautery are obtained quickly; and two or three flashes of heat from

the electrode, while it destroys the tissues which are in contact with the loop, do not have, in a chamber so moist as is that of the nose, any deleterious effect upon the adjacent surfaces. One of the most annoying effects in the use of the heated wire, is noticed in the removal of tumors from the roof of the naso-pharynx; for in this region the contact of the heated wire at the base of the growth is at the same time in close proximity to the structures at the orifice of the Eustachian tube, and the destruction of the tumor may go on coincidently with the roasting of the membranes at this orifice; but even in this instance the heated wire need be maintained for a short time only, as the loop is narrowed, it passes more and more toward the median line of the naso-pharynx and is to a corresponding degree, removed from the neighborhood of the tube.

The ease which the surgeon possesses of making eschars with this instrument, exposes him to the peculiar danger of attempting to do too much at a single sitting, and to hasten a treatment, otherwise tedious, by too often repeated or too deeply made applications. If the surgeon is desirous of reducing tumorefaction or swelling, I believe it is a rule, which should never be departed from, that the employment of extreme caution, producing slight effects with the wire at intervals of at least one day or two days apart, endeavoring to use the white heat in such a way as not to draw much blood, in other words to destroy the superficial or epithelial surface rather than the deep connective tissue or matrix, produces the best result in the long run. If, however, it is necessary to remove enlarged masses, the cautery-snare had best be employed in place of the electrode, (see p. 318). The slightest contact of the wire against the epithelium will at once carbonize the surface, while at the same time it will coagulate the albumen in the membrane beneath it. In this way, an effect is secured which is in every way comparable to that produced by caustics of the chemical group, such as nitric acid, etc.; whereas, if the destruction is deeply effected and hemorrhage ensue a lesion is established and the patient is subjected to the uncertainty attending a wound.

The wound may be the site of deposition of irritating substances in the air, of the diptheritic deposit, and at best is the location of tenacious clot-like exudations, which from the very fact that they form upon surfaces exposed constantly to the incoming and outgoing air soon become in part dessicated, and serve as sources of irritation to the surfaces already acknowledged to be in a morbid state. Whereas, if

the surgeon is content to produce localized death by making firm coagula of albumen, these will be thrown off slowly (say from three to five days) and will leave beneath them a healthy surface, which, as a rule, does not a second time form an eschar. A small surface being covered at a single sitting, permits the operator to make applications to adjacent areas, without waiting for an eschar to come off from a given surface. I have often at a single sitting produced slight eschars in both right and left nasal chambers, the roof of the pharynx, and the tonsil. As a rule, however, it is desirable to make an application to one spot only at a single sitting.

In the order of the locations to which applications are to be made, may be mentioned first, the under surface of the middle turbinated bone, which can readily be reached by a small straight cautery, the head being thrown well back on the shoulders; second, the under surface of the inferior turbinated bone, which can be reached by a large straight electrode, the head being held in an easy position, and the floor of the nose being horizontal to the axis of the body; third, the roof of the naso-pharynx, which can be readily reached, either by thrusting an instrument directly through the nose into the pharynx, or by bending one at a convenient angle, and permitting a small amount of platinum wire to be exposed; fourth, the tissue at the outer side of the middle turbinated bone, corresponding to the region at which the maxillary sinus communicates with the nose; fifth, the region at the sides of the pharynx, and the orifice of the larynx. One of the most interesting of such methods of application is that of reaching the roof of the naso-pharynx through the nose. If a perfectly straight instrument, placed into the nose, and be thrust back along the floor until it reaches an obstruction, being allowed to remain in this position, and the rhinal mirror being employed to inspect the naso-pharynx, the end of the electrode will be found resting against the roof of the pharynx; so that the roof of the naso-pharynx can be burned with absolute freedom and impunity, within the limits above named, by simply taking the electrode and forcing it through the nose as far as it will go and burning the tissue against which it rests. In this way, diseased tissues at the roof of the pharynx can be successfully treated when it will be impracticable to inspect them by the use of the rhinal mirror, or indeed, in any other way than the one here indicated.

By the employment of cocaine, the vessels can be notably constricted. In this way the soft cushiony masses of tissue can be held

well out of the way (a very great advantage), at the same time, the cocaine will exert its useful effect in obtunding sensibility. That the effect is to any extent that of a local anæsthetic, I have great reasons to doubt, but it is an exceedingly useful agent, and enables satisfactory treatments (often prolonged and tedious), to be borne by young children and nervous adults with the greatest possible satisfaction. It is curious that the cocaine is ineffectual in some instances. I have now under my care a child six years of age, upon whom it has utterly failed. It produced no constriction of the vessels, and no diminution of sensibility. In other instances, I have remarked that the effect is exceedingly transient, lasting only for five, at the utmost ten minutes, and is practically of no use in controlling exaltations of sensibility. Dr. F. H. Bosworth, was the first to record the striking effects of cocaine in constricting the blood vessels of the mucous membranes of the nose. It must, however, occur to any one who employs it, so decided are its effects in the majority of instances; but it is not a little curious that the first two patients upon whom I tried its effects were the two whose cases I have alluded to. The use of the cocaine must not be forgotten in connection with the employment of high grades of heat in the electrode. I have never ventured to use it on a surface which was very vascular, without first freely using the cocaine; for it is in every way probable that the scintillating white heat might cause free bleeding, no matter how little used, upon large uncontracted venous sinuses.

Since the weight of the handle of the electrode is considerable, it may under some circumstances be advisable to insert the electrodes (possibly one in either nasal chamber) and to touch lightly the free ends of the portions projecting beyond the nostrils with the handle of the electrode, at the time that the current is passed into the instrument by means of the interrupter. Of course, the moment the contact is made with the two poles of the electrode, there will be a flash of heat at the platinum loop which is lodged against the tissue desired to be cauterized. The advantage which is secured by applications made in this manner is conspicuous. In those patients who are unusually sensitive to pain or those who for any reason cannot properly control the motions of the head, such untoward disturbance cannot change the positions of the electrodes; for the backward and lateral motions of the head will simply break the contact between the electrode and the conducting wires. With the instrument in which the electrode and wires are firmly united (see Fig. 2), the motion of the head will often rudely disturb

the position, cause cauterizations to be made in undesirable parts, and prove in every way to be annoying and unsurgical. In some instances, I have employed an electrode which retains a long, slender, flexible platinum loop, which can take any form desired by moderately exerted pressure, and which when thrust through the nose so as to touch the vault of the pharynx will conform to the curvature of that wall, and thus enable the operator to reach a point much further back than he possibly could by a straight, rigid instrument.

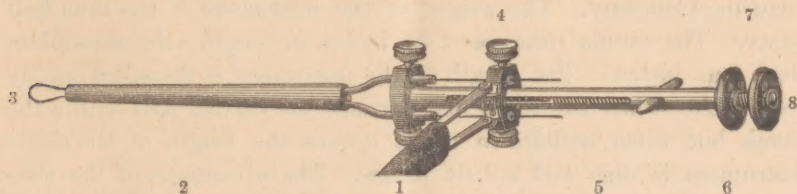


FIG. 3.—The galvano-cautery snare described in the text.—1, The cable of the battery; 2, the canula (which is not shown in full length); 3, the platinum wire; 4, the vulcanite carriage, with screws holding the ends of the platinum wire, with metallic contact with the hinge connections, by which the current is transmitted from the cables to the wire; 5, slotted barrel of aluminium; 6, a movable nut on the screw; 7, a small portion of the screw disengaged from the slotted barrel; 8, milled stationary screw-head.

A great advantage of the use of the galvano-cautery is its application to the principle of the snare. It is well known that a loop of wire which is steadily narrowed has great power in severing the attachment of tumors and other outgrowths. When of a large size they may be sufficiently powerful to pass through bony structures, as well as the softer parts of the body. The principle of the snare has been employed both in the throat, the ear, and the nose; but when my attention was first directed to this subject the forms available were too large and heavy for the delicacy of manipulation demanded in removing small tumors lodged in the narrower recesses of the nose. Moreover, no snare that I could then find would permit the galvanic current to pass through the loop at the time it was being narrowed. I was led, therefore, to inquire into the practicability of an instrument which would be at once light, of small size, and yet sufficiently powerful to remove that class of hypertrophied tissues and polypoid growths which are of such frequent occurrence in the nasal chambers. The instrument shown in Fig. 3 combines these qualifications, and satisfactorily performs the service for which it was designed. The only feature of an essential character which may be said to be novel is the fact that the platinum wire (3, Fig. 3) forming the snare is covered with a

uniform coat of copper, except alone the portion forming the loop, which is bare. As a consequence of this arrangement the current of electricity from the battery is conducted through a double canula (1, Fig. 3) by means of the copper.

The slotted barrel (5, Fig. 3) of the instrument, including the milled screw-head (8, Fig. 3) is of aluminium. The carriage (4, Fig. 3) is of vulcanite. The cables (1, Fig. 3) are attached to the carriage by a swinging pivot, the invention of Mr. Starr, of the S. S. White Manufacturing Company. The weight of the instrument is less than half ounce. The canula measures four inches in length; the aluminium shaft four inches. The length of the instrument is therefore exactly eight inches when the screw and carriage are carried well within the shank but when withdrawn to its utmost the length of the entire instrument is nine and a half inches. The advantages of the electrical snare over others in use are; the facility with which the small loop can be carried against a small growth not exceeding the size of a grain of wheat or corn; the ability to grasp readily the pedicle, and by a few turns of the movable nut to cut its way into the tumor, when by an application of the current, all points of resistance can be easily overcome. The most vascular structures may be freely entered and divided. If a growth be hard, resilient, or of a size so large as not to enable the loop to be readily engaged upon its base, the wire is simply held against the side of the growth, when the current will gradually burn its way into the mass to any extent which may be determined by the operator. When it is in this way received within the growth, the loop may, as before, be narrowed and a portion of it removed. It will be seen that failure to remove at least a portion of the growth attacked is an event exceedingly unlikely to occur. I have been particularly struck with the facility with which hypertrophies of the inferior turbinated bone can in this way be treated, and if cocaine be freely applied before the operation, it constitutes, in my judgment, the most speedy and the least painful of any means by which such conditions can be reduced. The current passing through the battery to the instrument can be interrupted by any of the numerous devices with which the practical electrician is familiar, or the treadle of the battery can be depressed and locked, and the interruption of the current be determined by the pressure of the finger on the key in the handle. This is under all circumstances desirable, since the weight of the cells is sufficient to demand considerable force to be exerted by the foot, always enough to destroy the delicacy of the manipulation of the instrument.



